

REMARKS

Claim Amendments

Claims 1-48 were pending and were rejected. Claim 1 has been amended to include the limitations of original claims 2 and 3. Original claims 2 and 3 and 35 have been cancelled. Claim 16 has been amended to include a proper antecedent basis. Claims 19 and 33 have been amended to further define an absorber disposed in a central region of the membrane. All the recitations added in the amended claims are fully supported in the specification. There is no new matter added. Reconsideration of currently pending claims 1, 4-34, and 36-48 is respectfully requested.

Claim Rejections Under 35 U.S.C. § 112.

Claim 16 was rejected Under 35 U.S.C. § 112 because "the triangular cross section" lacks antecedent basis.

Amended claim 16 provides an antecedent basis for "the triangular cross section", therefore the rejection of claim 16 under 35 U.S.C. § 112 should be withdrawn.

Claim Rejections Under 35 U.S.C. § 102.

Claims 1-3, 5-7,10, 14-16, 19, 21, 22, 24, and 28-30 were rejected under 35 U.S.C. 102 (b) as being anticipated by U.S. 4,754,139 to Ennulat et al.

Ennulat discloses an infrared sensor that is substantially different from the infrared sensor of the present invention. Ennulat 's sensor comprises an array of radiation concentrators 1 positioned directly above but spaced from a plurality of detectors 4, the detectors being supported on a detector support structure 2. (see Column 4, lines 44-49). The radiation concentrators 1 are preferably light metal concentrators with a high infrared reflecting surface and high thermal conductivity to provide uniform temperature distribution. (Column 4, lines 51-54). The support structure 2 is a separate piece from each of radiation concentrators 1. (see Figures 1-3). The purpose of support structure 2 is to mechanically support widely spaced detectors with minimum thermal conductance and to electrically connect these detectors to underlying integrated circuit chip 3. (Column 5, lines 30-33). In Figures 1-2, detectors 4 are

supported by relatively thin and narrow support ribbons 8 which bridge the interstices of the structure 2 with a low thermal conductivity material. (Column 4, lines 35-38).

Unlike the sensor of Ennulat, the infrared sensor of amended claims 1, 19 and 33 has a frame supporting the absorber (detector) and a plurality of reflecting surfaces (the radiation concentrator) included in a single structure, not separate structures spaced apart.

The infrared sensor of amended claims 1, 19 and 33 further includes a membrane for thermally isolating the absorber from the frame. The membrane serves as a thermal buffer between the absorber and the reflecting surfaces to prevent a thermal exchange between the absorber and the reflecting surfaces. (See Figures 1-5 of the present application). Ennulat's sensor does not include such membrane. As mentioned above, Ennulat has the radiation concentrators positioned directly above but spaced from a plurality of detectors 4.

Although Ennulat discloses ribbon 8, as stated above, ribbon 8 is structurally and functionally different from the membrane of amended claims 1, 19 and 33. The membrane of the amended claims 1, 19 and 33 has the absorber disposed in a central region thereon, and the membrane lies in the light collecting region (see Figures 1-5 of the present application). With this specific construction, the membrane thermally isolates the absorber from the reflecting surfaces. Additionally, the whole area of the absorber will receive more direct light that comes through in an angle (see Figure 3 and 9 in present application in comparison with Figure Ennulat Figure 2). Ribbon 8 of Ennulat, on the other hand, does not lie in the light collecting region. The portion of Ribbon 8 below the concentrator 1 is completely covered by detector 4, and thus is not at all exposed to the light coming through the light receiving area 9 (see Ennulat Figures 1 and 2). Ennulat's ribbon 8 does not serve to isolate detector 4 from reflecting surfaces.

Because the membrane of the present invention is supported by the frame which includes the plurality of reflecting surfaces, the assembling of the infrared sensor of the present invention is very simple. It does not require a separate frame structure or a folded ribbon for supporting the absorber as shown in Figures 2 and 3 of Ennulat. Since Ennulat does not teach, suggest, or motivate the use of the claimed membrane, the rejection based on Ennulat should be withdrawn.

Claim Rejections Under 35 U.S.C. § 103.

Claims 4, 20, 33-40 and 44-46 were rejected under 35 U.S.C. 103 (a) as being unpatentable over Ennulat et al. in view of U.S. 6,335,478 to Chou et al.

As stated above, Ennulat discloses a radiation concentration structure that is separate from the detector (absorber) supporting structure. The two structures are spaced apart to prevent a thermal exchange between the radiation concentrator which has high thermal conductivity (Column 4, lines 51-54) and the detector 4. In contrast, the configuration of the infrared sensor of the present invention utilizes a single frame structure defining reflecting surfaces having an absorber supporting membrane directly attached to the frame. The membrane serves as a thermal buffer between the reflecting surfaces and the detector 4. Ennulat does not teach the membrane or the configuration of the infrared sensor of the present invention. Chou's purported disclosure of a thermocouple does not teach nor suggest such a membrane. Combining Ennulat with Chou will not result in the infra red sensor of the present invention for the lack of the claimed membrane arrangement. Therefore, the rejection based on Ennulat in view of Chou should be withdrawn.

Claims 8, 9 and 23 were rejected under 35 U.S.C. 103 (a) as being unpatentable over Ennulat et al.

Claims 8, 9 now depend from amended claim 1, and claim 23 now depends from amended claim 19. As indicated above, amended claims 1 and 19 include a membrane arrangement that is not taught, suggested, or motivated by Ennulat. The light concentrator being silicon is an additional feature of claims 8, 9 and 23. As acknowledge by the examiner, Ennulat does not teach, suggest or motivate this feature. Even if this feature is to be combined with Ennulat, the infrared sensor of claims 8, 9, and 23 will not be achieved, for the lack of the claimed membrane arrangement. Accordingly, the rejection of claims 8, 9 and 23 should be withdrawn.

Claims 17 and 31 were rejected under 35 U.S.C. 103 (a) as being unpatentable over Ennulat in view of U.S. 5,910,659 to Johnson et al.

Like Ennulat, Johnson discloses a two structure device having an infrared source element 100 stacking on a separate structure of spatial decorrelator 200 leaving a separation distance between the two structures (Figure 2). The infrared source element 100 employs membrane 110 which suspends heater element 105 so as to bridge the cavity 125 (Col. 4, lines 26-27 see Figure 2).

Although Johnson illustrated in Figure 7 an infrared heater having infrared source element 105' monolithically integrated with a source spatial decorrelator 200'. (Col. 9, lines 32-35, Figure 7), Johnson states that the spatial decorrelator 200' directly supports the heater element 105' (Col. 9, lines 36-38, Figure 7). Johnson does not teach any membrane attached to the spatial decorrelator 200'.

Membrane 110 of Johnson is structurally and functionally different from the membrane of amended claims 1 and 19. Membrane 110 of Johnson is not supported by the frame that includes the reflecting surface, and does not serve to thermally isolate an absorber from the frame (reflecting surfaces).

There is nothing in Johnson or Ennulat that suggests or motivates a combination thereof. Even if the references are combined, the infrared sensor of claims 1, 19 and dependent claims 17 and 31 will not be achieved for the lack of the claimed membrane arrangement.

In addition, as acknowledge by the Examiner, claims 17 and 31 further recite a chamfered edges, the feature not taught by either Ennulat or Johnson. The significance of chamfered edges is described in the specification.

As is evident from a comparison of Figures 7 and 9, the distance between absorber 14 and light concentrator 104 is increased in infrared sensor 300 of Figure 9 because of chamfered edges 140, 142, 144, 146. An increase in distance between absorber 14 and the nearest sidewall surface decreases the thermal conduction from absorber 14, through the surrounding air, to light concentrator 104. Consequently, the total output signal from infrared sensor 300 is increased. Additionally, chamfered edges 140, 142, 144, 146 are sufficiently spaced from absorber 14 to render negligible the changes in thermal conductivity between absorber 14 and light concentrator 104 resulting from the positioning of light concentrator 104 during fabrication. More specifically, with undercut inner surfaces such as shown in Figure 9, light concentrator 104 is less likely to overhang opening 22 during fabrication. (Page 10, lines 1-13).

Based on the criticality of the chamfered edges feature, it is not proper to draw a conclusion that the modification is obvious within the level of skill in the art to provide such feature.

Accordingly, the rejection of claims 17 and 31 should be withdrawn.

Claim 47 was rejected under 35 U.S.C. 103 (a) as being unpatentable over Ennulat and Chou as applied to claims 4, 20, 33-40 and 44-46, and further in view of Johnson et al.

Claim 47 now depends from amended claim 33, which recites a membrane for thermally isolating the frame from the absorber, the membrane being supported by the frame and spanning the opening. Claim 47 further recites the chamfered edge feature.

As discussed hereinabove, neither Ennulat, Chou, nor Johnson discloses, suggests or motivates such claimed membrane arrangement or such chamfered edge feature.

There is nothing in the references that teaches, suggests or motivates the combination thereof. Even if the references are combined, the infrared sensor of claim 47 will not be achieved for the lack of the claimed membrane arrangement and the chamfered edge feature. Therefore, the rejection of claim 47 should be withdrawn.

Claims 11, 13, 18, 25, 27, and 32 were rejected under 35 U.S.C. 103 (a) as being unpatentable over Ennulat in view of U.S. 5,962,854 to Endo.

Claims 11, 13, 18, 25, 27, and 32 now depend from amended independent claim 1 or 19, both of which include a membrane arrangement not taught by Ennulat. Endo does not disclose, teach or suggest the claimed membrane arrangement, either. There is nothing in the references that teaches, suggests or motivates a combination thereof, and even if the references are combined, the infrared sensor of claims 11, 13, 18, 25, 27, and 32 will not be achieved due to the lack of the membrane arrangement. Accordingly the rejection of these claims based on Ennulat in view of Endo should be withdrawn.

Claims 41, 43, and 48 were rejected under 35 U.S.C. 103 (a) as being unpatentable over Ennulat and Chou as applied to claims 4-20, 33-40 and 44-46, and further in view of Endo.

Claims 41, 43, and 48 now depend from amended independent claim 33 which includes a membrane arrangement not taught by Ennulat, Chou or Endo. Combining the references will not result in the claimed invention. Accordingly the rejection of these claims should be withdrawn.

Claims 12 and 26 were rejected under 35 U.S.C. 103 (a) as being unpatentable over Ennulat and Endo as applied to claims 11, 13, 18, 25, 27, and 32, and further in view of U.S. 6,107,925 to Wong.

As stated hereinabove, Ennulat and Endo do not teach or suggest the claimed membrane arrangement. Wong also does not teach or suggest any thermal insulating membrane. Therefore combining of the references will not result in the infrared sensor of claims 12 and 26. Thus, the rejection of these claims should be withdrawn.

Claim 42 was rejected under 35 U.S.C. 103 (a) as being unpatentable over Ennulat, Chou, and Endo as applied to claims 41, 43, 48, and further in view of Wong.

Similar to what have been discussed hereinabove, claim 42 now depends from amended claim 33, which includes the claimed membrane arrangement. Neither Ennulat, Chou, Endo nor Wong teaches or suggests the membrane arrangement. There is nothing in the cited references that suggests or motivates the combination thereof. As stated earlier, the combined references will not yield an infrared sensor having a thermal insulating membrane attached to the frame defining the reflecting surfaces. Therefore the rejection of claim 42 should be withdrawn.

Based on the forgoing reasons, currently pending claims 1, 4-34, and 36-48 are now allowable.

CONCLUSION

Applicants believe that the application, as amended, is now in allowable form and action toward that end is respectfully requested. If any issues remain that can be resolved by telephone, Examiner Smith is invited to call the undersigned attorney at (317) 237-0300.

Respectfully Submitted,

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